CDS130 Final exam (PART I)

The final exam consists of two sections. The first section is a closed-book paper exam (60 minutes); and the second section involves use of Matlab on the computer (60 minutes). The following part is the first section of the exam.

- Write your name at the top of each page.
- This is a closed book exam.
- All computational commands and statements appearing in this exam are specifically referring to the Matlab programming language taught in class.
- You may not use Matlab on the computer during this section.
- Absolutely no interaction between students is allowed.
- Each question is worth 5 points. Partial credit may be awarded ONLY if work is shown.
- The exam will take place in IN 225.
- Duration for this section: 60 minutes (7:30 am – 8:30am).

Q1. What is the output of executing the following Matlab code?

```
clear;
for i=1:4
   for j=i:4
    M(i, j) = i+j;
    M(j, i)= M(i,j);
   end
end
M(4, 3)
```

Q2. Write a Matlab command that will generate a 4 × 4 matrix filled with random numbers between -0.1 and 0.1

Q3. What is the output of running the following matlab code?

```
Clear;
mat1(1,5) = 0.0;
mat2(1,5) = 0.0;
mat3(1,5) = 0.0;
for i = [1:3]
      mat1(i) = i*i;
      i=i+1;
      mat2(i) = i;
      mat3(i) = mat1(i) + mat2(i);
end
mat3
```

Q4. NAND gates are called universal logic gates. Domonstrate how an NOR gate can be formed by using NAND gates only.

Q5. Using nested for-loops to generate a matrix that has elements shown below (without typing the numbers explicitly):

$$A=\begin{pmatrix} 0 & 13 & 14 & 15 & 0 \\ 13 & 0 & 15 & 0 & 17 \\ 14 & 15 & 0 & 17 & 18 \\ 15 & 0 & 17 & 0 & 19 \\ 0 & 17 & 18 & 19 & 0 \end{pmatrix}$$

Q6. Given vectors x=[-1, 2, 3, -2], y=[0.2, 3.1, 0, -3] and z=[3, 0, 1, 0.1], provide answers to the following operations

(A) x < y > z

(B) x + ~y > z

Q7. Images in Matlab are represented by matrices. In order to properly display the image with
desired colors, a color map is needed (for indexed images). Given a matrix

$$M=\begin{pmatrix} 0.1 & 0.5 & 0.7 \\ 0.9 & 0.4 & 0.6 \\ 0.5 & 0.8 & 0.2 \end{pmatrix}$$

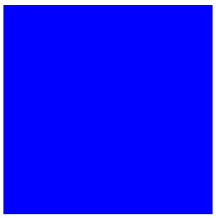
with the following Matlab code:

```
clear all;  clc;
M=[0.1, 0.5, 0.7; 0.9, 0.4, 0.6; 0.5, 0.8, 0.2];
imagesc(M)
colormap(M);
axis square off
```

Which of the following statements is most likely correct?

(A) No image will be produced, because the colormap is not properly assigned.

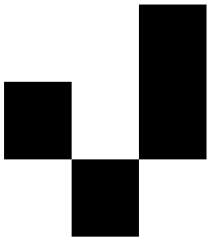
(B) The following image will be produced:



(C) The following 3-color image will be produced:

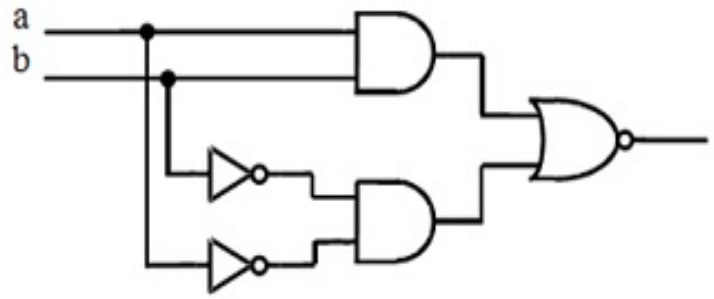
(D)The following 2-color image will be produced:

(E) The following white and black image will be produced:

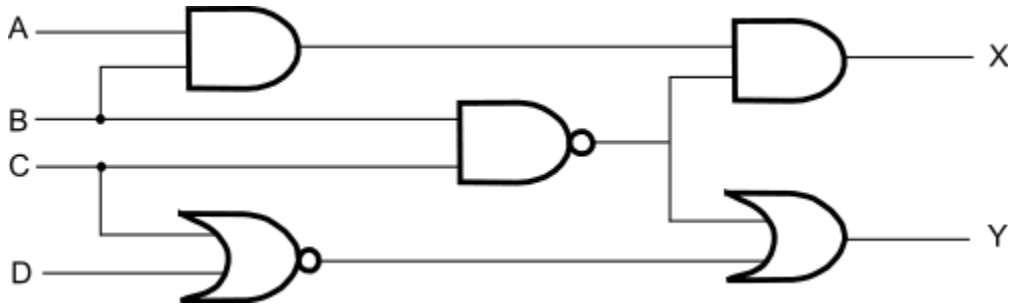


Answer: _____

Q8. Find the equivalent logic gate of the following combinations of NAND gates, and draw its graphic representation.



Q9. Consider the following logic circuit, with inputs A, B, C and D, and outputs X and Y. For ANY assignment of 1 or 0 to inputs A, B, C and D, which of the following statement is true?
(Note: Each of the four inputs, A, B, C and D must be assigned a value of either 1 or 0)



A. Output X = 1 and Y = 0 cannot be computed
B. Output X = 1 and Y = 1 cannot be computed
C. Output X = 0 and Y = 0 cannot be computed
D. Output X = 0 and Y = 1 cannot be computed
E. All four outputs can be computed

Q10. What is the output of running the following program?

```
clear all; clc;
A=-2:2;
B = ~A;
for i=1:4
  if A(i)
     B = B+ A(i);
  end
end

B
```